

## CLAIMS

### WHAT IS CLAIMED IS:

1           39.   (New) A method for providing precise control of a magnetic coupling field in  
2   a NiMn top spin valve head, comprising:  
3           forming a copper seed layer on a substrate;  
4           forming a free layer on the copper seed layer;  
5           forming a non-ferromagnetic layer on the free layer;  
6           forming a copper spacer layer on the non-ferromagnetic layer;  
7           forming a pinned ferromagnetic layer on the copper spacer layer; and  
8           forming a NiMn pinning layer over the pinned ferromagnetic layer;  
9           wherein the copper seed layer and copper spacer layer are oxidized separately during  
10   formation. .

1           40.   (New) The method of claim 39, wherein the forming the copper seed layer  
2   comprises depositing a layer of copper as a seed layer and, before depositing a next layer,  
3   oxidizing the copper seed layer.

1           41.   (New) The method of claim 40, wherein the forming the copper spacer layer  
2   comprises depositing a layer of copper as a spacer layer and, before depositing a next layer,  
3   oxidizing the copper spacer layer.

1           42.   (New) The method of claim 39, wherein the forming the copper spacer layer  
2   comprises depositing a layer of copper as a spacer layer and, before depositing a next layer,  
3   oxidizing the copper spacer layer.

1           43.   (New) The method of claim 39, wherein the copper seed layer and oxidized  
2 spacer layer are naturally oxidized for 80 seconds under  $8 \times 10^{-5}$  Torr of oxygen pressure.

1           44.   (New) The method of claim 39, wherein the oxidized copper seed layer and  
2 oxidized spacer layer reduce the ferromagnetic coupling field without deteriorating GMR  
3 effect or resistance.

1           45.   (New) The method of claim 39, wherein the oxidized copper seed layer and  
2 oxidized spacer layer provide a negative coupling field without affecting GMR effect or  
3 resistance.

1           46.   (New) The method of claim 39, wherein the oxidized copper seed layer and  
2 oxidized spacer layer change the crystalline texture growth of subsequent layers.

1           47.   (New) The method of claim 39, wherein the oxidized copper seed layer and  
2 oxidized spacer layer provide a negative coupling field that is achieved without affecting a  
3 GMR effect or resistance of the NiMn top spin valve head.

1           48.   (New) The method of claim 47, wherein the oxidized copper seed layer and  
2 oxidized spacer layer provide stronger growth of NiFe(111) and NiMn(111) with respect to  
3 NiFe(200) and NiMn(002) phases.

1           49.   (New) The method of claim 39, wherein the oxidized copper seed layer and  
2 oxidized spacer layer improve the interfacial roughness.

- 1           50.   (New) The method of claim 39, wherein the oxidation of the copper seed
- 2   layer and spacer layer does not affect asymmetry performance.